SREE VIDYANIKETHAN ENGINEERING COLLEGE

(AUTONOMOUS)

SREE SAINATH NAGAR, A. RANGAMPET - 517 102.

(Affiliated to Jawaharlal Nehru Technological University Anantapur, Ananthapuramu)

ASSIGNMENT

P.C.K. Chap.

Name of the Student : M.NIKHIL KUMAR REDDY H.T.No. 1 9 1 2 1 A 0 5 D 9

Year & Semester : II YEAR & II SEMESTER Branch : CSE Section : B

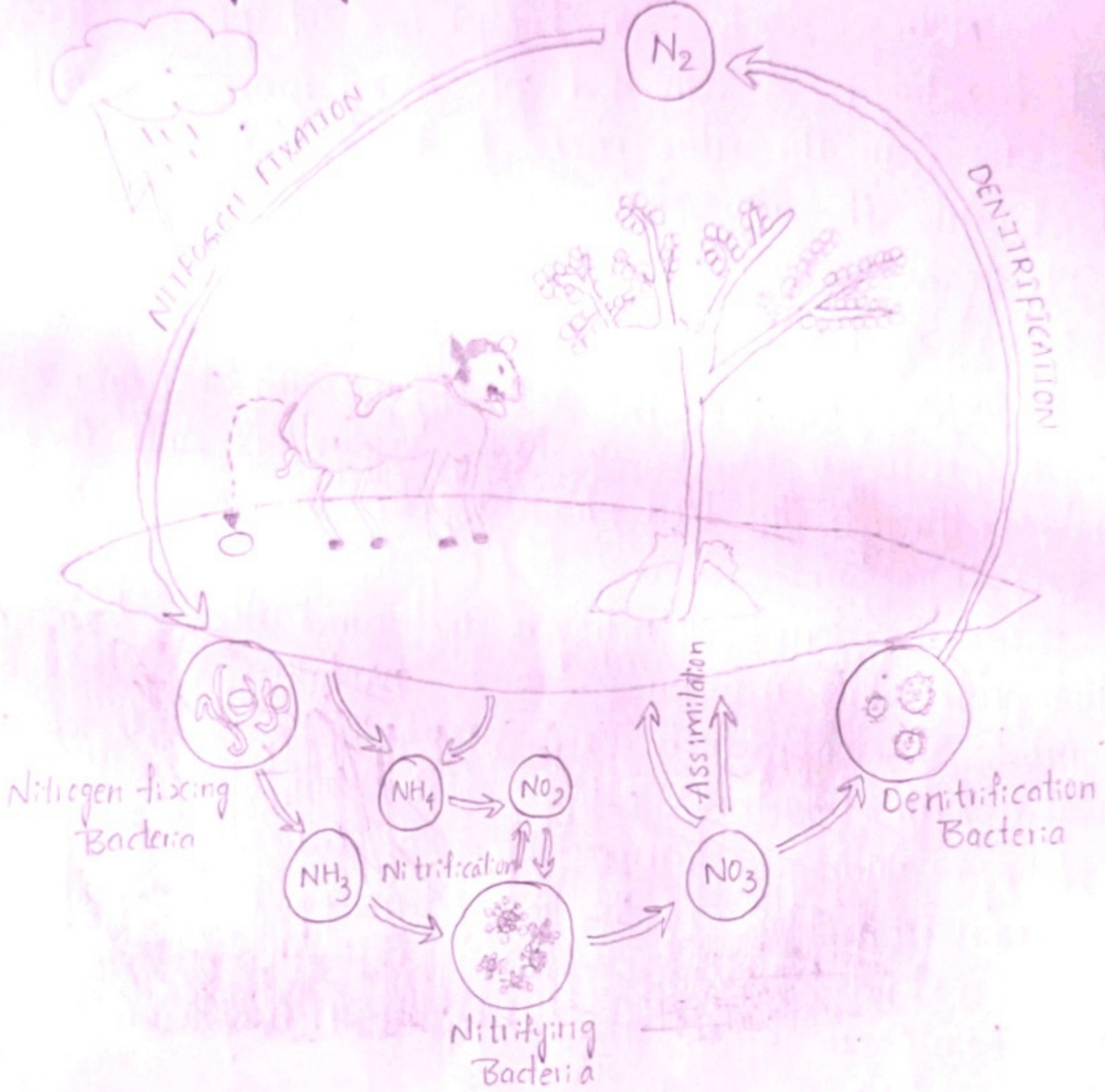
Name of the Subject : ENVIRONMENTAL SCIENCE Academic Year: 2020-2021

Signature of the Student : M.NIKHIL Signature of the Faculty:

Q.No.	1	2	3	4	5
Marks Awarded					

Total Marks

VIII 1. Illustrate nitrogen cycle with neat sketch.



Nitrogen cycle Definition:

" Nitrogen cycle is a biogeochemical process which transforms the inert nitrogen present in the atmosphere to a more usable form for living organisms."

Furthermore, nitrogen is a key nutrient element for plants. However, the abundant nitrogen in the atmosphere cannot be used directly by plants or animals. Read on to explore how the Nitrogen cycle makes usable nitrogen available to plants and other living organisms.

What is Nitrogen cycle?

Nitrogen cycle is a biogeochemical process through which nitrogen is converted into many forms, consecutively passing from the atmosphere to the soil to organism and back into the atmosphere.

It involves several processes such as nitrogen fixation, nitification, denitrification, decay and putefaction.

Nitrogen gas exists in both organic and inorganic forms. Organic nitrogen exists in living organisms, and they get passed through the food chain by the consumption of other living organisms.

Inorganic forms of nitrogen are found in abundance in the atmosphere. This nitrogen is made available to plants by symbiotic bacteria which can convert the inert nitogen into a usable form - Such as nitites and nitrates.

Nitrogen undergoes various types of transformation to maintain a balance in the ecosystem. furthermore, this process extends to various biomes, with the marine nitrogen cycle being one of the most complicated biogeochemical cycles.

Stages of Nitrogen cycle

process of Nitrogen cycle consists of the following steps - Nitrogen fixation, Nitrification, Assimilation, Ammonification and Denitrification. These processes take place in several stages and explained below.

Nitrogen fixation

It is the initial step of the nitrogen cycle. Here, Atmospheric nitrogen (N_2) which is primarily available in an inert form, is converted into the usable form - ammonia (NH_3).

During the process of Nitrogen fixation, the inert form of nitrogen gas is deposited into soils from the atmosphere and surface waters, mainly through precipitation. Later, the nitrogen undergoes a set of changes, in which two nitrogen atoms gets separated and combine with hydrogen to form ammonia (NH4+).

The entire process of Nitrogen fixation is completed by symbiotic bacteria which are known as Diazotrophs. Azotobacter and Rhizobium also have a major role in this process.

Nitrification

In this process, the ammonia is converted into nitrate by the presence of bacteria in the soil. Nitrites are formed by the oxidation of Ammonia with the help of Nitrosomonas bacterium species.

Assimilation

When plants or animals die, the nitrogen present in the organic matter is released back into the soil. The decomposers, namely bacteria or fungi present in the soil, convert the organic matter into ammonium. This process of decomposition produces ammonia, which further used for other biological processes.

Denitrification

Denitrification is the process in which the nitrogen compounds makes their way back into the atmosphere by converting nitrate (NO_3^-) into gaseous nitrogen (N). This process of the nitrogen cycle is the final stage and occurs in the absence of oxygen. Denitrification is carried out by the denitrifying bacterial species - clostridium and pseudomonas, which will process nitrate to gain oxygen.

2. What do you mean by bioremediation? Explain briefly.

Bioremediation is a process used to treat contaminated media, including water, soil and subsurface material, by altering environmental conditions to stimulate growth of microorganisms and degrade the target pollutants. Cases where bioremediation is commonly seen is oil spills, soils contaminated with acidic mining drainage, underground pipe leaks, and crime scene cleanups.

These toxic compounds are metabolized by where either an election acceptor (commonly oxygen) is added to stimulate oxidation of a reduced pollutant (e.g. hydrocarbons) or an election donor (commonly an organic substance) is added to reduce oxidized pollutants (nitrate, perchlorate, oxidized metals, chlorinated solvents, explosives and propellants).

Bioremediation is used to reduce the impact of byproducts created from anthropogenic activities, such as industrialization and agricultural processes. In many cases, bioremediation is less expensive and more sustainable than other remediation alternatives. other remediation techniques include, thermal desorption, vitrification, air stripping, bioleaching, rhizofiltration, and soil washing. Biological treatment, bioremediation, is a similar approach used to treat wastes including wastewater, industrial waste and solid waste. The end goal of bioremediation is to remove or reduce harmful compounds to improve soil and water quality.

Contaminants can be removed or reduced with varying bioremediation techniques that are in-situ or ex-situ. Bioremediation techniques are classified based on the treatment locality. In-situ techniques commonly require the contaminated site to be exavated which increases costs. In both these approaches, additional nutrients, vitamins, minerals, and PH buffers may be added to optimize conditions for the microorganisms. In some cases, specilized microbial cultures are added (biostimulation) to further enhance biodegradation. Some examples of bioremediation related techniques and technologies are phytoremediation, bioventing, bioattenuation, biosparging, composting (biopiles and windrows), and landfarming.

Most bioremediation processes involve oxidation-reduction (redox) reactions where a chemical species donates an electron (electron donor) to a different species that accepts the electron (electron acceptor). During this process, the electron donor is oxidized while the electron acceptor is reduced. Common electron acceptors in bioremediation processes include oxygen, nitrate, manganese (III and IV), iron (III), sulfate, carbon dioxide and some pollutants (chlorinated solvents, explosives, oxidized metals, and radionuclides). Electron donors include sugars, fats, alcohols, natural organic material, fuel hydrocarbons and a variety of reduced organic pollutants.

Limitations of bioremediation

Bioremediation can be used to completely mineralize organic pollutants, to partially tranform the pollutants, or alter their mobility. Heavy metals and radionuclides are elements that cannot be biodegraded, but can be bio-transformed to less mobile forms. In some cases, microbes do not fully mineralize the pollutant, potentially producing a more toxic compound. For example, under anaerobic conditions, the reductive dehalogenation of TCE may produce dichlorethyle (DCE) and vinyl chloride (VC), which are suspected or known carcinogens. However, the microorganism Dehalococcodies can further reduce DCE and VC to the non-toxic product ethene.

Additional research is required to develop methods to ensure that the products from biodegradation are less persistent and less toxic than the original contaminant. Thus, the metabolic and chemical pathways of the microorganisms of interest must be known. In addition, knowing these pathways will help develop new technologies that can deal with sites that have uneven distributions of a mixture of contaminants.

Also, for biodegradation to occur, there must be a microbial population with the metabolic capacity to degrade the pollutant, an environment with the right growing conditions for the microbes, and the right amount of nutrients and contaminants. The biological processes used by these microbes are highly specific.